

# PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventor DENIS MAULE ROBERTS

847.382



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## COMPLETE SPECIFICATION

### Improvements in Douglas D.C. 3 and like Aircraft

5 We, TRANSAIR LIMITED, a British Company of 7 and 8, Great Winchester Street, London, E.C.2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The invention relates to Douglas D.C. 3, Dakota and like Douglas aircraft which, as constructed by the makers, have main wheel wells which remain open when the wheels are retracted and constitute a source of considerable drag.

15 It is an object of the invention to reduce the drag by the provision of closure means for the wells and a further object is to provide such means which are simple in construction and reliable in operation. A still further object of one form of the invention is the provision of such means which may readily be incorporated as a modification to an existing aircraft.

25 In Douglas aircraft of the type with which the invention is concerned, each main landing wheel is carried by a strut which, in retracting, breaks at a knuckle joint intermediate in its length, the joint moving upwardly and forwardly into the well. There is also a radius rod connecting the wheel axle to a point on the aircraft structure at the rear of the well. 30 The well is provided in a portion of the engine nacelle behind the engine compartment and divided therefrom by a partition or fire-wall. The wheel moves upwardly and forwardly during retraction and when in its raised position the lowermost portion thereof remains protruding from the well. Such aircraft will hereinafter be referred to as "aircraft of the type referred to."

40 According to the invention a Douglas aircraft of the type referred to is provided for each landing wheel well with a pair of doors hinged to the nacelle, about fore and aft axes alongside the well and adapted to close against the sides of the lower part of the wheel when

raised, and means operable by the knuckle joint or an adjacent part of the strut as it moves upwardly, to effect closure of the doors.

50 It is preferred that the last part of the upward movement of the joint effects the closure.

55 There may also be provided, according to a preferred feature of the invention, a door or fairing which is attached to the radius rod and which closes the portion of the well behind the wheel when the wheel is retracted and the radius rod raised.

60 It is also preferred that there is a latch (or one latch for each door) which holds the doors in the open position and is released by the upward movement of the joint as a preliminary operation to the closing of the doors.

65 A specific example of the application of the invention to an existing Douglas D.C.3 aircraft will now be described with reference to the accompanying drawings in which:—

Figure 1 is a perspective view showing one main wheel of the aircraft, in lowered position and the doors open,

70 Figure 2 is a perspective view from the front and below the main wheel in raised position and the doors closed,

75 Figure 3 is a diagrammatic perspective view from above and behind showing the doors open and the operating means for the doors,

Figure 4 is a side view showing the operation of nacelle doors and

80 Figure 5 is a view from the rear, of the fire wall and the parts of the door mechanism which are attached thereto. This Figure shows on the left side the parts in the doors-open position and on the right side the parts in the doors-closed position.

85 The arrangement for each main wheel is the same and only one will be described.

90 In this example there is a pair of moulded fibre-glass doors 10 which are hinged to the engine nacelle 11 about fore and aft axes 12 at each side of the wheel well 14. The edges 16 of the doors are shaped to fit against the

sides of the tyre 17 when the wheel is retracted, thereby to leave the lower part of the tyre exposed.

5 The door edges have brushes 18 or other resilient material for engaging the tyre.

Attached to the fire wall 20 at the front of the well 14 there are, in accordance with the invention, two upright channels 21 with undercut or dove-tail edges. The channels are spaced 10 by an amount equal to or a little less than the spacing of the wheel struts 22 and slope upwardly and forwardly at a small angle to the vertical (see Figure 4).

In each channel there is a dovetail slide 24 15 which is of substantial length and is held in place by the undercut edges. The lower end 24a of each slide is connected by a link 25 and universal joints to a bracket 26 on the inside of the corresponding door 10. At the 20 upper end each slide has a short rearwardly directed arm 28 and, immediately beneath the arm, a latch 29. The latch is in the form of a bell-crank of which one limb extends rearwardly and lies under the arm 28 on the slide 25 and the other limb extends downwardly and has a latch hook at its lower end for latching engagement under the lower edge of a plate 30 fixed across the mouth of the channel at the lower end of the movement of the latch. 30 The hook is spring-urged into such engagement.

35 Stretched between each slide and attachment points low down on the fire wall there are two rubber bungees (not shown) which urge the doors to the open position.

The radius rod 32 of the undercarriage is of Y form and secured to the underside thereof there is, in accordance with this example, a door or fairing 33 of corresponding outline. 40 The door 33 is positioned and shaped to close the rear portion of the wheel-well when the rod is raised. To secure the door there is a cross-bar 34 fixed between the arms of the rod 32 with a pair of adjustable dependent arms 35 to which the door is attached and an attachment bracket 36 secured to the leg of the rod. 45

In the operation of the above construction, the first and major part of the retraction of 50 the wheel is idle so far as the operation of

the wheel doors is concerned. Towards the end of the movement the knuckle joints 37 of the wheel struts (or the wheel arch 38, or abutments attached thereto) contact the rear limbs 55 of the latches (see Figure 4) and raise the limbs to disengage the latch hooks from the plates 30 and to engage the limbs with the arms 28 on the slides 24. As retraction progresses the joints 37 push the slides upwardly and so draw the doors 10 towards their closed position 60 which they reach when the wheel is fully raised. When raised the rear of the well is closed by the fairing on the radius rod.

On lowering of the wheel the doors are opened by the bungees which pull the slides 24 downwardly until the latches engage. 65

#### WHAT WE CLAIM IS—

1. A Douglas aircraft of the type referred to provided for each landing wheel well with a pair of doors hinged to the nacelle, about 70 fore and aft axes alongside the well, and adapted to close against the sides of the lower part of the wheel when raised, and means operable by the knuckle joint or an adjacent part of the strut as it moves upwardly, to effect closure of the doors. 75

2. An aircraft as claimed in claim 1 in which the last part of the upward movement of the joint effects the closure.

3. An aircraft as claimed in claim 1 or claim 2, having a door or fairing which is 80 attached to the radius rod and which closes the portion of the well behind the wheel when the wheel is retracted and the radius rod raised. 85

4. An aircraft as claimed in any one of the preceding claims having a latch which holds the doors in the open position and is released by the upward movement of the joint as a preliminary operation to the closing of the doors. 90

5. A Douglas aircraft having doors and fairings for the wheel wells constructed and arranged for operation substantially as herein described and shown in the accompanying 95 drawings.

BOULT, WADE & TENNANT,  
111 & 112, Hatton Garden, London, E.C.1,  
Chartered Patent Agents.

#### PROVISIONAL SPECIFICATION

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This invention relates to Douglas D.C.3, Dakota and like Douglas aircraft which, as constructed by the makers have main wheel wells which remain open when the wheels are 105 retracted and constitute a source of considerable drag.

It is an object of the invention to reduce the

drag by the provision of closure means for the wells and a further object is to provide such means which are simple in construction and reliable in operation. A still further object of one form of the invention is the provision of such means which may readily be incorporated as a modification to an existing aircraft. 110

In Douglas aircraft of the type with which the invention is concerned, each main wheel is carried by a strut which, in retracting, breaks at the knuckle joint intermediate in its 115

length, the joint moving upwardly and forwardly into the well. There is also a radius rod connecting the wheel axle to a point on the aircraft structure at the rear of the well. The well is provided in a portion of the engine nacelle behind the engine compartment and divided therefrom by a partition or fire-wall. The wheel moves upwardly and forwardly during retraction and when in its raised position the lowermost portion thereof remains protruding from the well.

According to the invention a Douglas aircraft of the above type is provided for each wheel well with a pair of doors hinged to the nacelle, about fore and aft axes alongside the well, and adapted to close against the sides of the lower part of the wheel when raised, and means operable by the knuckle joint, or an adjacent part of the strut, as it moves upwardly to effect closure of the doors.

It is preferred that the last part of the upward movement of the joint effects the closure.

There may also be provided, according to a preferred feature of the invention, a door or fairing which is attached to the radius rod and which closes the portion of the well behind the wheel when the wheel is retracted and the radius rod raised.

It is also preferred that there is a latch (or one latch for each door) which holds the doors in the open position and is released by the upward movement of the joint as a preliminary operation to the closing of the doors.

A specific example of the application of the invention to an existing Douglas D.C.3 aircraft will now be described.

The arrangement for each main wheel is the same and only one will be described.

In this example there are a pair of moulded fibre-glass doors which are hinged to the nacelle about fore and aft axes at each side of the wheel well. The edges of the doors are shaped to fit against the sides of the wheel and tyre when the wheel is retracted, thereby to leave the lower part of the tyre exposed. The door edges have brushes or other resilient material for engaging the wheel.

Attached to the fire wall at the front of the well there are, in accordance with the invention, two upright channels with under-cut or dove-tail edges. The channels are spaced by an amount equal to or a little less than the spacing of the wheel struts and slope upwardly and

forwardly at a small angle at the vertical.

In each channel there is a slide which is of substantial length and is held in place by the under-cut edges. The lower end of each slide is connected by a link and universal joints to a bracket as the inside of the corresponding door. At the upper end each slide has a short rearwardly directed arm and, immediately beneath the arm, a latch. The latch is in the form of a bell-crank of which one limb extends rearwardly and lies under the arm on the slide and the other limb extends downwardly and has a latch hook at its lower end for latching engagement with a slot in a bar fixed across the mouth of the channel at the lower end of the movement of the slide. The hook is spring-urged into such engagement.

Stretched between each slide and attachment points low down on the fire wall there are two bungees which urge the doors to the open position.

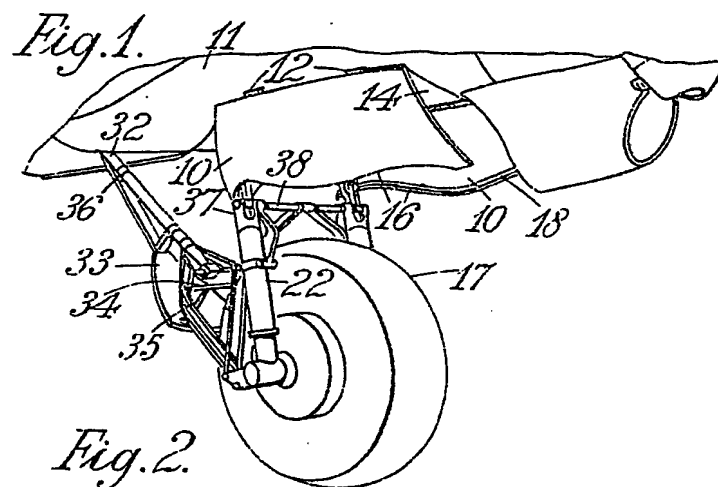
The radius rod is of Y form and secured to the underside thereof there is, in accordance with this example a door or fairing of corresponding outline. The door is positioned and shaped to close the rear portion of the wheel-well when the rod is raised. To secure the door there is a cross-bar fixed between the arms of the rod with a pair of adjustable dependent arms to which the door is attached and an attachment bracket secured to the leg of the rod.

In the operation of the above construction, the first and major part of the retraction of the wheel is idle so far as the operation of the wheel doors is concerned. Towards the end of the movement the knuckle joints of the wheel struts (or the wheel arch, or abutments attached thereto) contact the rear limbs of the latches and raise the limbs to disengage the latch hooks and to engage the limbs with the arms on the slides. As retraction progresses the joints push the slides upwardly and so draw the doors towards their closed position which they reach when the wheel is fully raised. When raised the rear of the well is closed by the fairing on the radius rod.

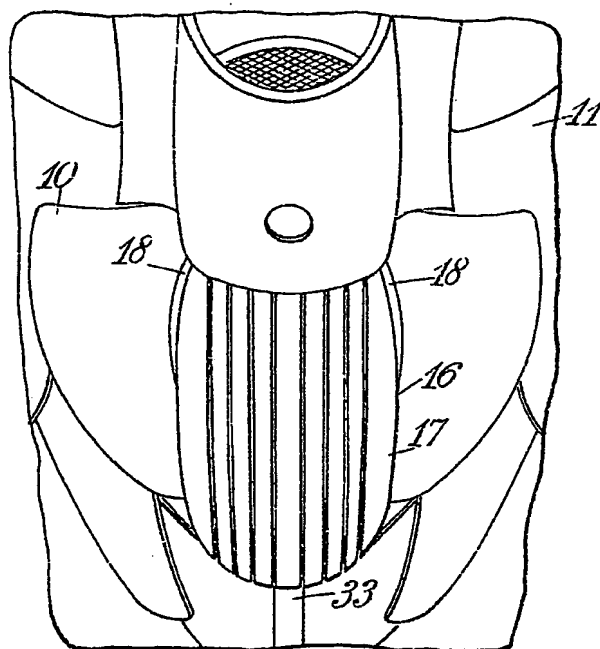
On lowering of the wheel the doors are opened by the bungees which pull the slides downwardly until the latches engage.

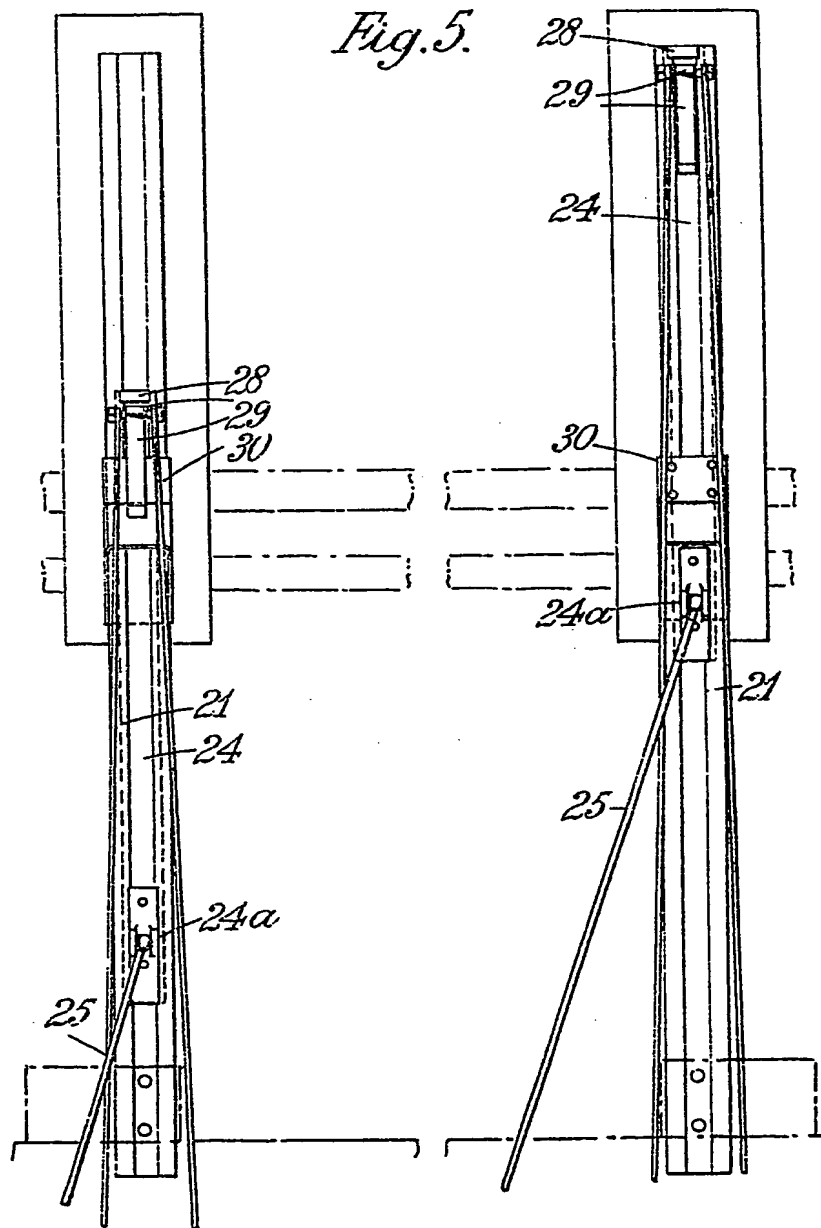
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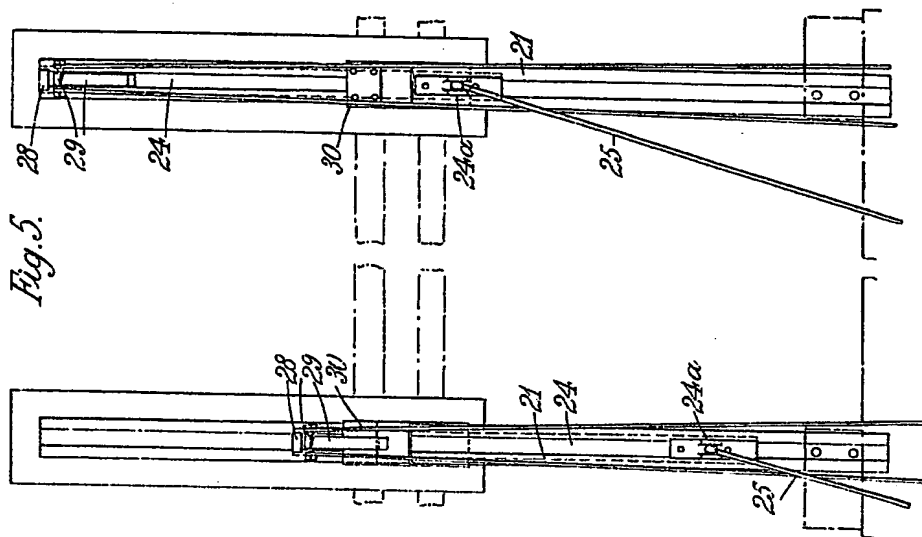
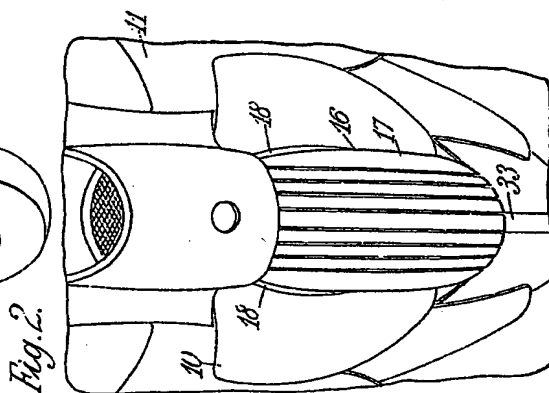
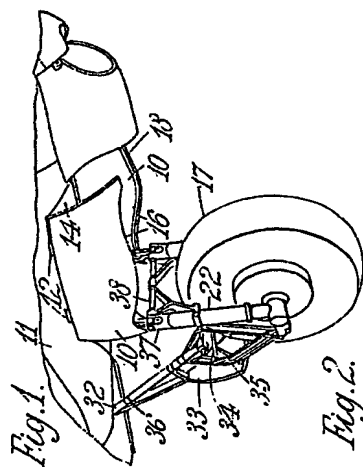
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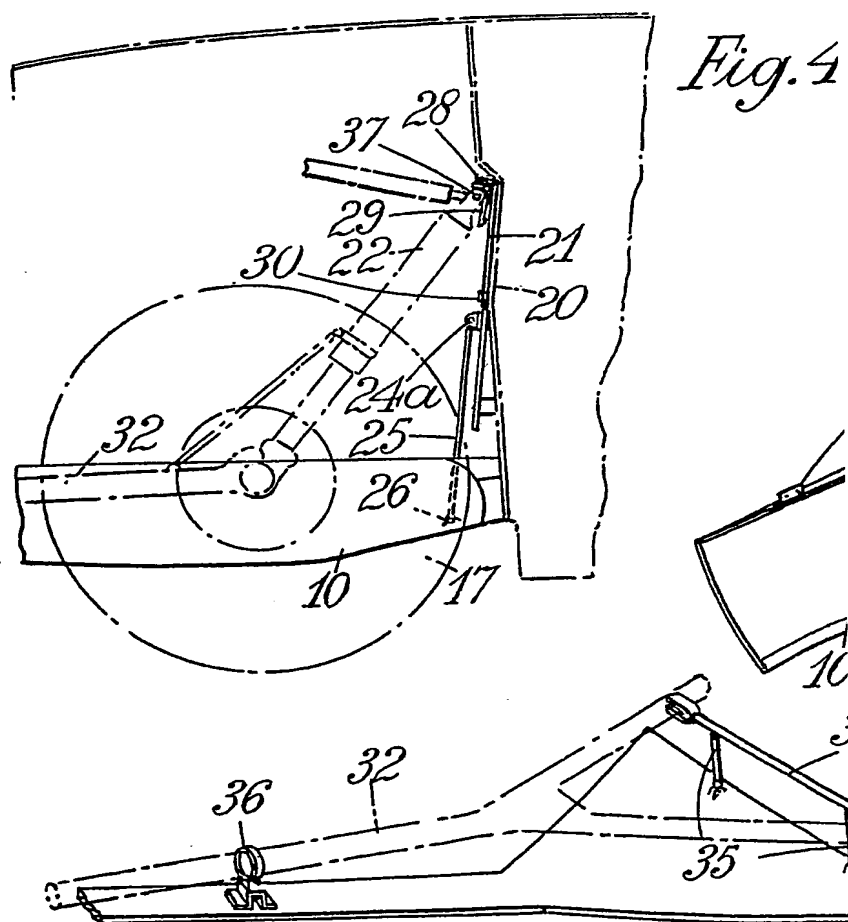


*Fig. 2.*

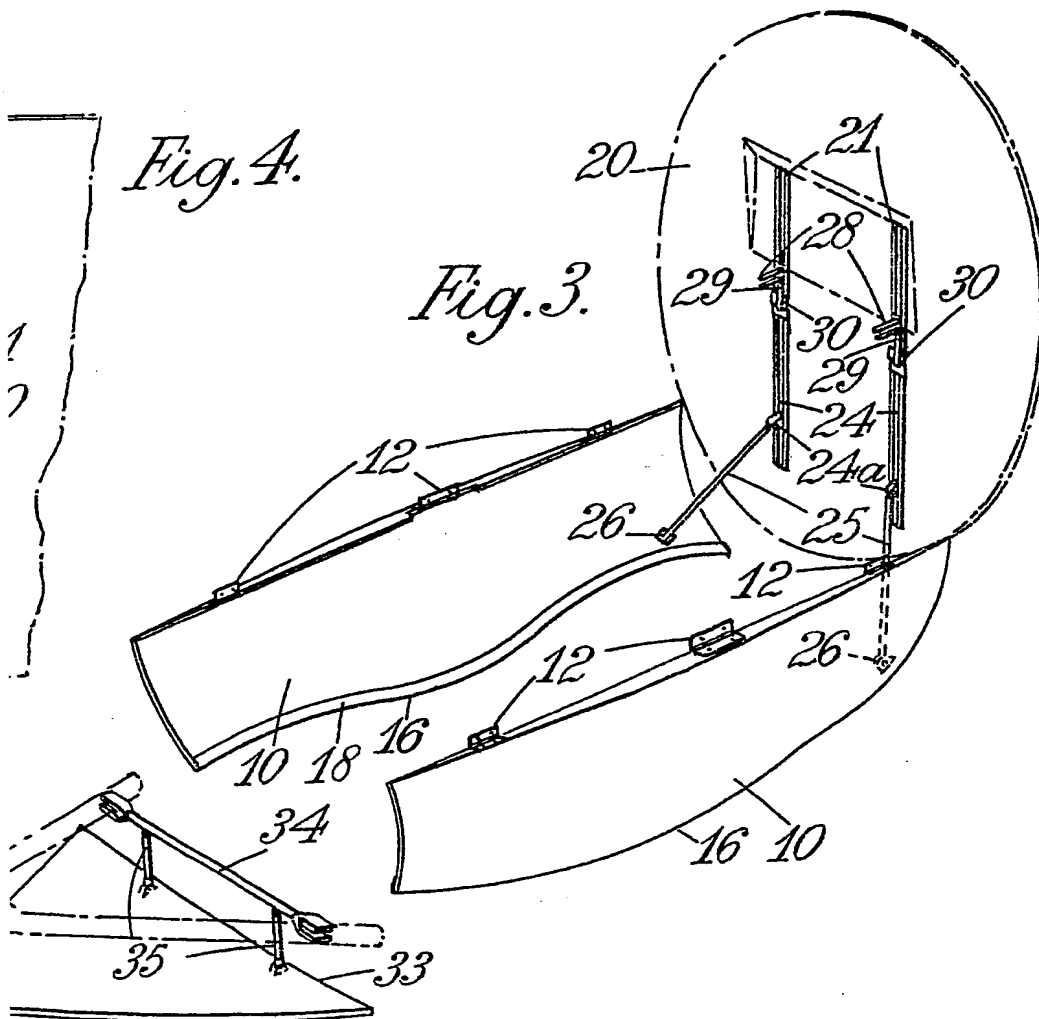


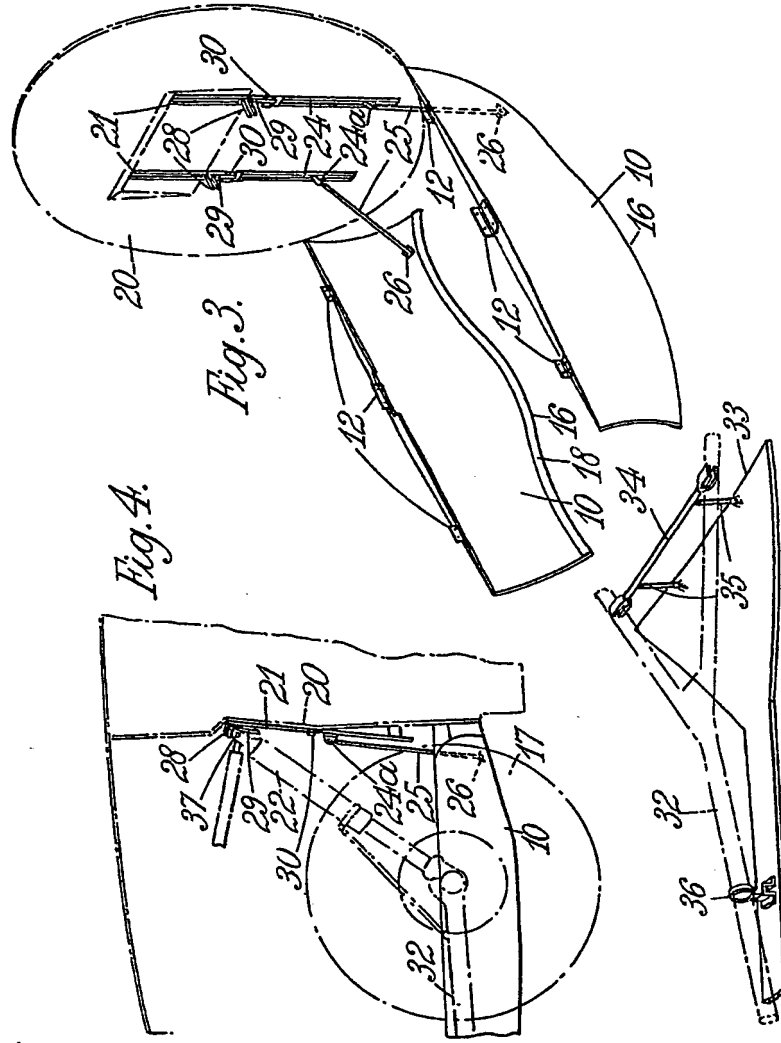






*Fig. 4*





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